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Editorial Comment

Rotational Coronary Atherectomy*

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Since the advent of percutaneous coronary balloon angioplasty for the treatment of critical coronary artery stenosis, a high rate of restenosis has plagued the procedure (1–3). This has led to the design and deployment of new techniques including directional and rotational coronary atherectomy, endovascular stenting, laser balloon angioplasty, thermal balloon angioplasty, drug delivery balloon catheters (4)—and perhaps many more, because human imagination is limitless. Most devices have been used in living patients and have shown promising results with immediate postprocedure reduction of stenosis. These successes should not be surprising because most of the devices utilize balloons and balloon angioplasty currently has a success rate of nearly 90% (5). In light of the proliferating number of new procedures and devices, it is incumbent on us to design and review studies in a critical manner and to require follow-up of at least 3 to 6 months before considering any new approach to be even potentially useful. We must recognize that the use of newer devices is usually limited to higher risk patients with diffuse coronary disease or restenosis after previous balloon angioplasty. Also, as has been previously demonstrated with balloon angioplasty, refinement of technology and operator experience will lead to higher success rates. Thus, a new procedure may appear less effective than a previously established procedure, (balloon angioplasty, for example) (6).

The present study. In this issue of the Journal, Teirstein et al. (7) describe their experience with high speed rotational coronary atherectomy in patients with diffuse (lesions >1 cm long) and focal (lesions ≤1 cm long) coronary artery disease with a mean angiographic follow-up time of 6 months in 90% of the patients. The immediate overall procedural success occurred in 76%, which compares with a historical success rate of approximately 88% with balloon angioplasty and directional atherectomy. There was a greater success rate for short lesions (≤1 cm [92%]) than for longer lesions (>1 cm [70%]). There were 10 procedural failures: abrupt arterial closure (n = 1) with subsequent death after emergency coronary bypass grafting; severe coronary artery narrowing requiring balloon angioplasty (n = 1); hypotension in a patient with marked left ventricular dysfunction (n = 1); postprocedural stenosis >50% (n = 3); and failure to cross the lesion with a guide wire (4). Moreover, the procedure was associated with a small non-Q wave myocardial infarct in 19% of patients, a result that is not surprising given that the size of particles from plaque abrasion by the Rotablator varies from 1 to 250 μm (8) and that 77% are <5 μm; these particles may be thrombogenic and therefore may increase in size while in circulation, lodge in small vessels and result in focal ischemic necrosis. Embolization of particulate matter may not be significant when left ventricular function is normal or mildly depressed but when it is poor, these episodes may become clinically important in the immediate postprocedure period or may lead to permanent depression of left ventricular function (although the latter was not demonstrated in this study).

Comparison with previous studies on restenosis. Previous studies with balloon angioplasty have indicated that the incidence of restenosis is related to the severity of postangioplasty residual stenosis (5). Conventional balloon angioplasty is termed successful if the resultant residual stenosis is <50% (9). Atherectomy devices usually produce less residual stenosis than conventional angioplasty by about 5% to 15% (10), but it is uncertain whether the decrease in residual stenosis from atherectomy-induced debulking will reduce the incidence of restenosis. A preliminary report by Lin et al. (11) indicated that the immediate residual stenosis had little impact on restenosis. Similarly, high restenosis (30% to 38%) rates have been reported with atherectomy devices (10,12). In the present study, Teirstein et al. (7) demonstrate that lesion length may be a more important predictor for restenosis after high speed rotational atherectomy compared with postangioplasty residual stenosis. In the present study, the restenosis rate was 22% for lesions ≤1 cm and 75% for long lesions (>1 cm) whereas residual stenosis of ≤30% or >30% resulted in similar restenosis rates (56% and 61%, respectively). Also, new lesions and restenosis lesions had similar restenosis rates (55% and 67%, respectively). Lesion length has also been correlated with greater restenosis rate when balloon angioplasty is applied alone (11,13).

The reasons for greater restenosis with longer lesions with rotational atherectomy are not known. Pathologic examination in one artery after failed rotational atherectomy demonstrated the findings of balloon angioplasty (which was performed) and included focal disruption of the fibrous cap with hemorrhage into the plaque and thrombus. There were intimal and medial dissection and flap formation. An occlusive thrombus may have formed as a result of exposure of a large thrombogenic surface after rotational atherectomy.

Merits of the present study. Overall, the study by Teirstein et al. (7) is well designed to assess the usefulness of high speed rotational coronary atherectomy for patients with

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diffuse coronary artery disease. The merits of the study include use of only one technique, use in high risk patients, a reasonably long follow-up in 90% of patients, use of the device in vessels of similar size, detailed analysis of lesion length and postprocedural lumen stenosis. Teirstein et al. (7) recommend that high speed rotational coronary atherectomy not be used for long coronary lesions >1 cm in length in vessels ≤3 mm in diameter. However, this procedure may be useful in short lesions with a projected relatively low rate of restenosis (22%).

Limitations of the study. These include selection bias: a large percent of patients had diffuse coronary artery disease, previous restenosis and ostial lesions and thus the group was inhomogeneous with a relatively small number of short lesions. Because use of the device was limited to vessels ≤3 mm in diameter, its value in large vessels was not addressed. Additionally, the study did not address the issues of eccentricity, calcification and plaque morphology as predictors of outcome or the role of risk factors for atherosclerosis in restenosis.

Conclusions. High speed rotational coronary atherectomy designed to reduce restenosis rate may be useful only in patients with short lesions with a vessel size ≤3 mm. However, these claims must be interpreted with caution because only a small proportion of the patients studied had short lesions. The results reported by Teirstein et al. (7) should not be interpreted as negative because increased operator experience and design improvements may decrease restenosis rates. It is also possible that concurrent use of rotational atherectomy with balloon angioplasty and stenting may provide hope for patients whose condition is inoperable and who are high risk candidates for balloon angioplasty.

References

1. Gruentzig AR, Senning A, Siegenthaler WE. Nonoperative dilatation of coronary artery stenosis: percutaneous transluminal coronary angioplasty. N Engl J Med 1979;301:61–8.
2. Holmes DR Jr, Vlietstra RE. Balloon angioplasty in acute and chronic coronary artery disease. JAMA 1989;261:2109–15.
3. Serruys PN, Luijten HE, Beatt RJ, et al. Incidence of restenosis after successful coronary angioplasty: a time-related phenomenon. Circulation 1988;77:361–71.
4. Baim DS, Detre K, Kent K. Problems in the development of new devices for coronary intervention: possible role for a multicenter registry (editorial). J Am Coll Cardiol 1989;14:1389–92.
5. Detre K, Kolubov R, Kelsey S, et al. Percutaneous transluminal coronary angioplasty in 1985–1986 and 1977–1981: the National Heart, Lung, and Blood Institute registry. N Engl J Med 1988;318:265–70.
6. Hillis LD. Efficacy and safety of coronary balloon angioplasty and directional atherectomy. Circulation 1990;82:305–7.
7. Teirstein PS, Warth DC, Haq N, et al. High speed rotational coronary atherectomy for patients with diffuse coronary artery disease. J Am Coll Cardiol 1991;18:1694–701.
8. Prevosti LC, Cook JA, Unger EF, et al. Particulate debris from rotational atherectomy: size distribution and physiologic effects (abstr). Circulation 1988;78(suppl II):II-83.
9. Ryan TJ, Faxon DP, Gunnar RM, et al. Guidelines for percutaneous transluminal coronary angioplasty: a report of the American College of Cardiology/American Heart Association Task Force on Assessment of Diagnostic and Therapeutic Cardiovascular Procedures (Subcommittee on Percutaneous Transluminal Coronary Angioplasty). J Am Coll Cardiol 1988;12:529–45.
10. Safian RD, Gelbfish JS, Erny RE, Schnitt SJ, Schmidt DA, Baim DS. Coronary atherectomy: clinical, angiographic, and histological findings and observations regarding potential mechanisms. Circulation 1990;82:69–79.
11. Liu MW, Roubin GS, King SB. Does an optimal luminal result after PTCA reduce restenosis? (abstr). Circulation 1989;80(suppl II):II-63.
12. Simpson JB, Robertson GC, Selmon MR, Sipperly ME, Braden LJ, Hinohara T. Restenosis following successful directional coronary atherectomy (abstr). Circulation 1989;80(suppl II):II-582.
13. Ghazzal CMB, Weintraub WS, Baalbaki HA, et al. PTCA of lesions longer than 20 mm: initial outcome and restenosis (abstr). Circulation 1990;82(suppl II):II-509.